

Appl. No. 10/579,849
Amdt. dated July 13, 2007
Reply to Office action April 13, 2007

AMENDMENT TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

Claims 1-9. (Canceled)

10. **(Currently amended)** In a fuel injection device, for an internal combustion engine with direct fuel injection, having a housing and at least two valve elements, ~~located in the housing and coaxial to one another, to each of which at least one fuel outlet opening is assigned, and on the outer valve element, radially outward from the at least one fuel outlet opening assigned to it, there is a first sealing region, which cooperates with a valve seat on the housing and which can separate the at least one fuel outlet opening from a high-pressure connection, the improvement comprising an additional sealing region on the outer valve element, between the at least one fuel outlet opening assigned to it and the inner valve element comprising:~~

an inner valve element and an outer valve element inserted coaxially to one another into the housing;

at least one first fuel outlet opening disposed in the housing and associated with the outer valve element;

at least one second fuel outer opening disposed in the housing and associated with the inner valve element;

a valve seat disposed in the housing which valve seat is engaged and disengaged with the inner valve element and the outer valve element to open and close the associated fuel outlet openings from a high-pressure fuel connection;

a first sealing region cooperating with the valve seat and disposed on the outer valve element in a location radially outward from the at least one first fuel outlet opening; and

a second sealing region cooperating with the valve seat and disposed on the outer valve element between the at least one first fuel outlet opening and the inner valve element;

wherein a gap initially exists following initially assembly of the device, between the second sealing region and the valve seat there-opposing the outer valve element in a closed position, wherein the gap is preferably approximately 1 to 2 μm .

11. (Currently amended) In a fuel injection device, for an internal combustion engine with direct fuel injection, having a housing and at least two valve elements, located in the housing and coaxial to one another, to each of which at least one fuel outlet opening is assigned, and on the outer valve element, radially outward from the at least one fuel outlet opening assigned to it, there is a first sealing region, which cooperates with a valve seat on the housing and which can separate the at least one fuel outlet opening from a high-pressure

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connection, the improvement comprising an additional sealing region on the outer valve element, between the at least one fuel outlet opening assigned to it and the inner valve element comprising:

an inner valve element and an outer valve element inserted coaxially to one another into the housing;

at least one first fuel outlet opening disposed in the housing and associated with the outer valve element;

at least one second fuel outlet opening disposed in the housing and associated with the inner valve element;

a valve seat disposed in the housing which valve seat is engaged and disengaged with the inner valve element and the outer valve element to open and close the associated fuel outlet openings from a high-pressure fuel connection;

a first sealing region cooperating with the valve seat and disposed on the outer valve element in a location radially outward from the at least one first fuel outlet opening; and

a second sealing region cooperating with the valve seat and disposed on the outer valve element between the at least one first fuel outlet opening and the inner valve element;

wherein the first sealing region is embodied by a sealing edge of a first annular groove extending around the outer valve element, and wherein the first groove has an

approximately semicircular cross-section and wherein at least a portion of the semicircular cross-section of the groove is located generally opposing the at least one first fuel opening The fuel injection device in accordance with claim 10, wherein the additional sealing region, immediately after the manufacture of the device, with the outer valve element closed, has a slight spacing, preferably approximately 1 to 2 μm , from the valve seat associated with it.

12. (Cancelled)

13. (Currently amended) The fuel injection device in accordance with claim 10, wherein the first sealing region is embodied on the edge of a first annular groove extending around the outer valve element and further comprising a second elongated an encompassing shallow groove extending approximately from the first encompassing groove approximately into the additional to the second sealing region on the outer valve element.

14. (Currently amended) The fuel injection device in accordance with claim 11, wherein the first sealing region is embodied on the edge of a groove extending around the outer valve element and further comprising a second elongated an encompassing shallow groove extending approximately from the first encompassing groove approximately into the additional to the second sealing region on the outer valve element.

15. **(Currently amended)** The fuel injection device in accordance with claim 10, wherein the first sealing region is embodied on the edge of a first annular groove extending around the outer valve element and further comprising a plurality of second elongated grooves distributed over the circumference and all extending in the axial direction approximately from the first encompassing groove approximately into the additional to the second sealing region.

16. **(Currently amended)** The fuel injection device in accordance with claim 11, ~~wherein the first sealing region is embodied on the edge of a groove extending around the outer valve element and further comprising a plurality of second elongated grooves distributed over the circumference and all extending in the axial direction approximately from the first encompassing groove approximately into the additional to the second sealing region.~~

17. **(Currently amended)** The fuel injection device in accordance with claim 10, wherein the second additional sealing region is embodied by a sealing on the edge of a third radially an encompassing narrow, deep groove, which third groove is located in the direction toward the first sealing region.

18. **(Currently amended)** The fuel injection device in accordance with claim 11, wherein the second additional sealing region is embodied by a sealing on the edge of a third radially an encompassing narrow, deep groove, which third groove is located in the direction toward the first sealing region.

19. (Cancelled)

20. (Currently amended) The fuel injection device in accordance with claim 13, wherein the second additional sealing region is embodied by a sealing on the edge of a third radially an encompassing narrow, deep groove, which third groove is located in the direction toward the first sealing region.

21. (Currently amended) The fuel injection device in accordance with claim 15, wherein the second additional sealing region is embodied by a sealing on the edge of a third radially an encompassing narrow, deep groove, which third groove is located in the direction toward the first sealing region.

22. (Currently amended) The fuel injection device in accordance with claim 10, wherein the second additional sealing region is embodied on an annular protuberance projecting from the outer valve element.

23. (Currently amended) The fuel injection device in accordance with claim 11, wherein the second additional sealing region is embodied on an annular protuberance projecting from the outer valve element.

24. (Cancelled)

25. **(Currently amended)** The fuel injection device in accordance with claim 10, further comprising a guide gap between the two valve elements, and wherein the guide gap ~~communicates with a chamber that communicates at least from time to time with~~ is connected to the high-pressure connection via a hydraulic control chamber.

26. **(Currently amended)** The fuel injection device in accordance with claim 11, further comprising a guide gap between the two valve elements, and wherein the guide gap ~~communicates with a chamber that communicates at least from time to time with~~ is connected to the high-pressure connection via a hydraulic control chamber.

27. **(Canceled)**

28. **(Currently amended)** The fuel injection device in accordance with claim 17, further comprising a guide gap between the two valve elements, and wherein the guide gap ~~communicates with a chamber that communicates at least from time to time with~~ is connected to the high-pressure connection via a hydraulic control chamber.

29. **(Currently amended)** A method for producing a fuel injection device in accordance with claim 10, comprising the steps of:

fabricating the outer valve element such that an initial gap is provided between the second additional sealing region and its associated valve seat, with the outer valve element in a closed position, initially has a slight spacing, wherein the initial gap is preferably of

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approximately 1 to 2 μm , from a valve seat associated with it, and that then by repeated actuation of ; and

repeatedly actuating the outer valve element and thereby deforming; the first sealing region and/or the valve seat associated with it ~~is deformed~~ such that the initial gap spacing between it and the valve seat associated with it becomes less or tends toward zero.